Great Lakes Marine Transportation System
White Paper Prepared for the Midwest Freight Corridor Study

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I. Historical Perspective of the Great Lakes Marine Transportation System

The Great Lakes Marine Transportation System (GLMTS) has been a commercial trade route for thousands of years. Routes established by the Native Americans were used in the early fur trading days to link together a vast inland network that predates today's hub and spoke distribution centers. The importance of the trade route resulted in three wars being fought for control of the Great Lakes.

Prior to the advent of the railroad the GLMTS was one of the primary routes in the westward expansion of the United States. The opening of the Erie Canal in 1824 provided an all water route to the rapidly growing port of New York and maritime trade on the Great Lakes flourished. Other canals were built that allowed maritime commerce to enter the Ohio River system through: Toledo, and Ohio, the Mississippi river system at Green Bay, Wisconsin. As the population in the regions around the lakes expanded maritime trade was the primary method of transportation. When railroads were introduced they were linked through ports to the GLMTS. The Chicago ship canal built in 1900 linked the GLMTS to the Mississippi river system creating the largest all water route to the inland river system.

To this day, the movement of vast storehouses of natural resources in the heartland of the US and Canada relies on an efficient GLMTS. Thousands of ships have been built and operated on the Great Lakes. Transportation efficiency is a hallmark of the vessel operators on the GLMTS with two examples being self-unloaders and the use of mariner for line handling. Fleets of ships have been built to carry all varieties of commerce and the GLMTS has a long history of world cruise and day passenger ships. During World Wars I & II Great Lakes shipbuilders made major contributions of merchant and warships to the services of US and Canada.

The two nations had created lasting maritime agreements on the use of the GLMTS addressing cross border trading, environmental issues, and vessel safety. The vessel operators were responsible for actively promoting safe efficient operations including the introduction of the traffic separation lanes, off season maritime educational programs, and other world renown ideas. Future improvements and expansion of the GLMTS will rest on a legacy of innovation, efficiency, environmental stewardship and safety.

II. Current Operations

The Great Lakes Marine Transportation System (GLMTS) includes Lakes Ontario, Erie, Huron, Michigan, and Superior, their connecting waters, and the St. Lawrence River. It is one of the largest concentrations of fresh water on the earth. The system, including the St. Lawrence River above Iroquois Dam, has a total shore of about 11,000 statute miles (9,559 nautical miles, nm), a total watersurface area of about 95,000 square statute miles (24,600,000 hectares). With the opening of the St. Lawrence Seaway, the system provides access by oceangoing deep-draft vessels to the great industrial and agricultural heartland of the North American continent. From the Strait of Belle Isle at the mouth of the Gulf of St. Lawrence, the distance via the St. Lawrence River to Duluth, MN at the head of Lake Superior is about 2,340 statute miles (2,03nm) and to Chicago, IL near the southern end of Lake Michigan is about

2,250 statute miles (1,955nm). About 1,000 statute miles (870 nm) of each of these distances is below Montreal, the head of a deep-draft ocean navigation on the St. Lawrence River.

The GLMTS serves 15 major international ports and some 50 regional ports on both sides of the border. Maritime commerce on the system supports domestic and international trade, and provides a competitive advantage to a wide range of industries. A recent economic impact study of the St. Lawrence Seaway System estimated the revenue benefit to the US economy to be $3.4 billion, personal income and consumption benefit of $4.3 billion and federal state and local tax revenue of $1.3 billion per year.[1] The study examined growth patterns for the system from 1991 to 2000 and found constant expansion in jobs, revenue, tonnage, and economic indicators for the decade.

Marine transportation on the system involves three general trade patterns:

- **Seaway Trade:** traffic moved on the Seaway, much of which is overseas import/export trade.
- **Great Lakes Trade** consists of interlake (between lakes) or intralake (within one lake) domestic or bi-national trades contained within the Great Lakes.
- **Lake -River Trade** is traffic that moves to and from the Great Lakes via the connecting Inland River System.

Seaway Trade

The current Seaway lock system was completed in 1959 and provides an all water route direct to the head of lakes ports of Duluth/Superior in the US and Thunder Bay, Ontario in Canada. The route offers significant savings in distance and cargo handling for products that originate in the heartland bound for European or North African ports. The distance advantage is, to a degree, offset by the slow speed of passing through the lock system and also the diseconomies of scale due to the relatively small ships that the locks can accommodate. As world trade and ship size grew, the number of vessels that could use the seaway declined never reaching its potential. The Seaway trades have lately been in the range of 50 million tonnes a year. Seaway cargoes are borne both by Canadian-flag and foreign-flag ocean vessels. The U.S.-flag laker fleet is almost exclusively employed in the interlake trades however the grain trade from the head of the lakes ports uses part of the seaway system to reach Buffalo, NY. Current Seaway trade patterns include:

- Upbound (westward) movements of general cargo, including semi-finished steel in the form of slabs, coils, structural forms, and other products from overseas producers.
- Upbound movements of iron ore from mines in eastern Canada.
- Downbound (eastern) shipments of export grain by Canadian bulkers to transshipment points on the St. Lawrence River and by ocean vessels for direct export overseas.

The Seaway also handles project cargoes, forest products, petroleum products, containers, chemicals, edible oils, coal, salt, cement, fertilizers, ores, nonferrous metals, and other bulk commodities. Tolls for use of the Seaway locks are charged for Canadian but not US locks.

Great Lakes Trade

The interlake and intralake trades, approaching some 200 million tonnes a year, are dominated by the dry bulk commodities of iron ore, coal, stone and grain. Also moved within the Lakes are salt, cement, potash and liquid bulk cargoes such as petroleum products, asphalt and industrial chemicals. This commerce is handled by U.S. and Canadian-flag fleets in the Great Lakes. Some of the larger movements within the Lakes are:

- Iron ore, in the form of taconite pellets, moving from the Minnesota Iron Range and Michigan's Upper Peninsula to steel mills around Lakes Michigan and Erie.

- Low-sulphur coal mined in the western U.S., railed to Great Lakes loading ports and moved on water to electrical generating stations on the Great Lakes,
- Coal mined in the eastern U.S. moved to steel mills, generating stations, and other industries.
- Stone moved from quarries to steel mills and taconite plants for flux, and to all major markets for construction.

Lake-River Trade

The GLMTS currently has direct, all water connection to two major river systems. Vessels can travel from Lake Michigan to the Illinois and Mississippi river system via the Chicago ship canal. Vessels can also move from the Great Lakes to the Hudson River system via the New York State Barge Canal (Erie Canal).

New York State Barge Canal

The Erie canal route has significant size restrictions and is primarily used for the delivery of vessels, recreation, and some minor movement of aggregate products. Barges and small vessels can travel from New York Harbor via the Hudson River and New York State Barge Canal System to Lake Ontario at Oswego, NY a distance of 340 statute miles (295.5 nm), or to the Niagara River at Tonawanda, NY; a distance of 496 statute miles (431 nm). All Erie Canal System lock dimensions are 328 feet long, 45 feet wide. The area available for vessels within a lock is 300 feet (91.4 meters); long, 43.5 feet (13.2 meters); wide and controlling draft of 12 feet (3.7 meters); but the most significant restrictions are bridge clearance (air draft) limit of 15.5 feet (5.8 meter) and speed restriction of 5 mph.[2]

Chicago Ship Canal and Illinois Waterway System

The Chicago ship canal was originally created in 1900 to divert sewage away from the growing metropolis's supply of fresh water from Lake Michigan as well as provide a marine connection. The canal also currently provides fresh water to communities outside the Great Lakes basin. The basin is the land in which all precipitation, rivers, and streams flow back to the lake. A 1967 U.S. Supreme Court decree allows Chicago and its suburban communities to divert up to 2.1 billion gallons a day from Lake Michigan. The Water Resources Development Act of 1986 requires unanimous approval from the eight Great Lakes governors for any city that lies outside the Great Lakes basin to receive water and it is unlikely that other communities around the lakes will in the future be allowed to build canals that divert water from the Great Lakes.

The diversion of water lowers Lake Michigan's lake level by about 2 inches and is also a pathway for exotic species. The Chicago diversion enabled the zebra mussel to move from the Great Lakes into the Mississippi River. There are real concerns that the Asian carp, a voracious eater, will find its way into Lake Michigan from the Mississippi via the canal.

Barges and small vessels can travel from the Gulf of Mexico via the Mississippi River and the Illinois Waterway to Lake Michigan at Chicago, IL, a distance of about 1,530 statute miles (1,329.5 nm) The canal, has limits of depth, 9 feet (2.7); width, 80 feet (24.38 meters); length, 600 feet (182.88 meters); and vertical clearance 17 feet (5.18 meters). There are no tolls on this route.

GLMTS Capacity

The primary measures that are used to determine the capacity of the GLMTS are the number of vessels that transit locks, call at ports and tonnage carried. The waiting time, number of vessels locked through and the historical comparison with past shipping clearly

indicate that the system has significant upward capacity potential. GLMTS is part of a very competitive transportation system. Rail, truck, the inland river system and the St. Lawrence Seaway system are often competing for freight. Finding methods to improve the GLMTS's efficiencies, streamline the system, and reduce costs will make the GLMTS more competitive and expand its use.

III. Governance and Regulation of the GLMTS

The GLMTS cuts across local, state, and national borders. More than any other mode it is a joint private and public sector enterprise. The private sector owns virtually all of the vessels and most of the terminals on the GLMTS. Governmental agencies are responsible for keeping the waterways open and functioning at optimum efficiency. By its nature and operation the GLMTS is intermodal which means it interacts and depends on access to and interaction with the other modes.

Operating, maintaining, and constructing transportation systems within state boundaries are very difficult tasks. The complex regulatory and governance structure of the GLMTS greatly increased the difficulty of these tasks. A GLMTS marine carrier in cross border trade will have to comply with approximately thirty sets of US and Canadian regulations that are administered by ten different departments on the federal and provincial level alone. In most cases the interaction will result in a fee, tax, toll, or tariff being paid to one or more of the agencies. When construction, maintenance and regulation are considered the US has at least 18 different federal agencies with responsibilities relating to marine transportation systems.[3] Jurisdictions between agencies often overlap with differing objectives further complicating the process.

As the oldest transportation system for the two nations, there is significant legacy legislation and regulation that has not been well coordinated. Unlike air or highway transportation the GLMTS does not have, even at the US federal level, a single agency to direct and coordinate activities. The institutional goals and divisions of responsibility of the dispersed federal government agencies do not always correspond to how the GLMTS is organized and functions today as an intermodal system. The primary US and Canadian agencies with responsibilities in the operation of the GLMTS are listed as follows.

- Transport Canada
- U.S. Army Corps of Engineers
- U.S. Department of Transportation
- The St. Lawrence Seaway Management Corporation (Canada)
- Saint Lawrence Seaway Development Corporation (United States)
- Environment Canada
- U.S. Fish and Wildlife Service
- US Department of Homeland Security
- State agencies of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, and Pennsylvania
- The Provincial regulatory agencies of Ontario and Quebec
- County, state, village governments and planning commissions
- Numerous non-regulatory government agencies such as the US Maritime Administration and non-governmental agencies like The Great Lakes Commission are active in support of the GLMTS

The list is not comprehensive. An additional extensive but still partial listing of agencies with interests and concerns about the GLMTS can be found on the Great Lakes Commissions

website. http://www.great-lakes.net/links/econ/orgs_transp.html The fifty year old Great Lakes Commission is a nonpartisan, binominal compact agency created by state and U.S. federal law and dedicated to promoting a strong economy, healthy environment and high quality of life for the Great Lakes - St. Lawrence region and its residents. The Commission consists of state legislators, agency officials, and governors' appointees from its eight member states. Associate membership for Ontario and Québec was established through the signing of a "Declaration of Partnership." Some multi-state collaborative efforts such as the Great Lakes Regional Collaboration effort have been stymied by a lack of funding.[4]

The cross border location of the GLMTS requires that long lasting programs be coordinated through both US and Canadian agencies. There is a long history of the two nations working together including the planning and construction of the current St. Lawrence Seaway. Bi-national initiatives such as the following example will be essential for the optimum use of the GLMTS.

Bi-National initiatives

On May 01, 2003 the US and Canadian Governments signed a memorandum of cooperation on the Great Lakes St. Lawrence Seaway System.

The Memorandum of Cooperation enhances collaboration between both governments, and helps them to:

- Assess the economic, environmental and engineering factors associated with the current and future needs of the Great Lakes St. Lawrence Seaway commercial navigation system;
- Identify factors and trends affecting the domestic and international marine transportation industries serving the Great Lakes St. Lawrence Seaway, including evolving intermodal linkages and transportation technologies; and
- Evaluate the reliability and condition of the Great Lakes St. Lawrence Seaway, including the ongoing maintenance and capital requirements of sustaining and optimizing the existing marine transportation infrastructure on which it depends.

In order to carry out the goals outlined in the memorandum of cooperation the agencies involved started a Great Lakes Short Sea Shipping Study (GLSSS) that is due out in the fall of 2006. Canadian and American officials agreed that obtaining a baseline snapshot of existing engineering infrastructure, and current economic and environmental conditions would prove invaluable in determining what actions would be required to ensure no operational degradation in the System for the next 50 years. The study calls for an assessment of the System's current and future requirements to maintain safety, reliability, viability and efficiency at levels consistent with those present today. The scope of the study is limited to the evaluation of the existing marine transportation infrastructure. It is important to note that the focus of the study is on the optimization of the existing infrastructure based on the system's current configuration and that the evaluation of major infrastructure modifications, such as an expansion of the Seaway locks or an increase in channel dimensions is not part of the GLSSS study.[5]

IV. Physical Challenges to Optimizing the Use of the GLMTS

Physical Constraints

A waterway that extends over 2,300 miles east to west and over 400 miles north to south into the middle of a continent is impacted by physical limitations. In most instances the barriers to water transportation have been overcome by technology. There are some constraints on the system that current or even future technology may not be able to change.

Winter Operations

Winter operation on the Great Lakes is restricted during the height of winter due to ice conditions and closure of the locks. Vessels that would elect to operate during this period would need an ice strengthened hull, rudder, and propeller and would be limited to operational areas not requiring locking. Air temperatures on the Great Lakes can go as low as –50 degrees F (–46 degrees C) with ice covering a large portion of the northern Great Lakes and most of the harbors.

Despite the severe weather, there have been trial year round operations in intralake service and interlake service on the Great Lakes. The Great Lakes Commission members have proposed extensions of the season.[6] Year round service in the Baltic and North Sea regions can provide excellent examples of effective ice operations. Foreign shipbuilders are building ice capable vessels with ballast water systems that exceed the IMO standards and are suitable for GLMTS trade. Lock repair and maintenance downtime issues need to be addressed. The building of a second Poe size lock could be a significant factor in extending the season. If global warming is a reality, the Great Lakes navigation season may steadily increase to the point of year round service. Should that occur then new supply chain options would open in the region.

Lake Levels

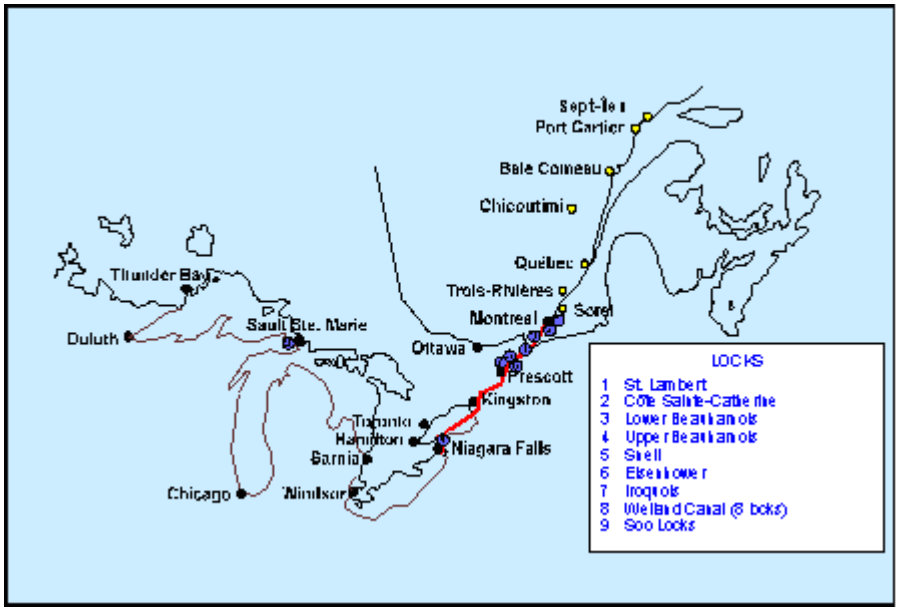
Lake level fluctuations occur on a cyclical basis and they can reduce or raise water level in some lakes by as much as 19.5 inches (.5 meters). These fluctuations can impact a vessel's carrying capacity and in turn the total capacity of the GLMTS. Concerns have been raised about global warming and the potential impact on Great Lakes shipping.[7] The NOAA study postulates that if global warming continues lake levels will drop anywhere between 2-3 feet. Such a drop could have significant impact on future GLMTS in terms of vessel cargo carrying capacity but this may be offset by an extended or year-round shipping season.

Global warming may have the impact of reducing or even elimination ice cover on many of the Great Lakes. While the phenomena may be a decade away, that is not a long time frame when considering transportation infrastructure changes. If global warming is a reality, the Great Lakes navigation season may steadily increase to the point of year round service. Should that occur then new supply chain options would open in the region. There should be studies by planning agencies and transportation academics on how an ice free GLMTS could be utilized to maximum benefit

Locks

It should be recognized that ships that want to trade in the Great Lakes system have to fit within the physical dimensions of the St. Lawrence Seaway and Welland Canal locks. Vessels that trade into Lake Superior must be able to fit through the locks at the Sault.

Seaway and Great Lakes Lock Systems



Map from St. Lawrence Seaway Corporation website

Seaway Locks

The St. Lawrence Seaway proper extends from Montreal to Lake Erie. The Seaway locks (fifteen in total) overcome the differences in elevation in the system. The Montreal/Lake Ontario section encompasses a series of seven locks over roughly 300 kilometers (187 miles), with five Canadian and two American locks, from Montreal, Quebec to Iroquois, Ontario enabling ships to navigate between the St. Lawrence River and Lake Ontario. The Welland Canal links Lake Ontario and Lake Erie with a series of eight locks over approximately 42 kilometers (27 miles) – all Canadian. The Welland Canal provides more than half the lift needed between tidewater and the lakehead.

All of the seven locks of the Montreal/Lake Ontario section of the Seaway (St. Lambert, Côte Ste. Catherine, Lower and Upper Beauharnois, Bertrand H. Snell, Dwight D. Eisenhower, and Iroquois) as well as those of the Welland Canal, are 233.5 meters long (766 feet), 24.4 meters wide (80 feet) and 9.1 meters deep (30 feet) over the sill.

Responsibility for the operations and maintenance of the navigational aspects of the Canadian portion of the Seaway (thirteen locks) resides with the St. Lawrence Seaway Management Corporation, a not-for-profit corporation, under a long-term management agreement with the Government of Canada pursuant to the Canada Marine Act. The Government of Canada continues to own all fixed assets of the Canadian Seaway.

The two United States locks in the Seaway are operated and maintained by the Saint Lawrence Seaway Development Corporation, a wholly owned government corporation within the U.S. Department of Transportation.

The Soo locks at Sault Ste. Marie, Michigan provides a vital connection between the upper Great Lakes and Lake Superior. Access to Lake Superior and the Canadian lakehead at Thunder Bay, Ontario and the U.S. lakehead at Duluth, Minnesota is gained via the locks on the St. Mary's canal. The locks are operated and administered by the U.S. Army Corps of Engineers.

The two locks currently operational for commercial navigation purposes are the Poe and the MacArthur. The Poe lock is 1200 feet long (366 meters), 110 feet wide (33.5 meters) and 32 feet deep (9.8 meters). The MacArthur lock is 800 feet long (244 meters), 80 feet wide (24.4 meters) and 31 feet deep (9.4 meters).

Challenges to the Inland Waterways System

The majority of the locks and lock chambers in place on the Mississippi and Ohio river waterways are less than 1,000 feet in length. The U.S. Army Corps of Engineers reports that 15% of the locks are 1,000 to 1,200 feet long, 60% are 600-900 feet long, while 25% are less than 600 feet long. Furthermore, about 50% of the locks and dams are over 50 years of age and reaching the end of their economic life.

Not only is age and the need to replace these aging locks and dams a constraint on the ability of the inland waterways to handle cargo in the future, but the size of the locks limit the size of the tow that can pass through the lock system. A 1,200-foot lock can accommodate a tow consisting of 17 barges, while the older locks of 600 feet or less can only accommodate tows consisting of 8 barges. Since the majority of the tows on the upper Mississippi River System, consist of 12 or more barges, the tows must be split in half in order to transit a 600-foot lock. The splitting of the barge tow results in an increase in transit time for cargo with delays as barges wait to enter the locks. Additional constraints are that the Illinois and Mississippi river system are subject to floods, ice conditions and drought.

Locks Improvements

The current Seaway Locks were built small due to political pressure from East Coast ports and the railroads that had a concern that a larger seaway would take trade from their routes. The end result of building locks that were obsolete when completed is that the majority of today's seagoing vessels cannot fit into the locks. There have been a number of studies and recommendations to expand the locks. One of the principal physical constraints to expansion is the depth of water available in channels, rivers, and other waterways that is an average of 30 feet (9.1 meters). The extensive dredging required to bring the entire GLMTS to a significantly greater depth would be time consuming, expensive, and may have adverse environmental consequences. However the locks could be widened to 110 feet and lengthened without changing the depth and the improved locks would accommodate the majority of handy size seagoing vessels.

Efforts to build a second large lock at the Sault have been under way since the 1980s. Those efforts received significant assistance under the provisions of the Water Resources Development Acts of 1996 and 1999, in which Congress reduced the states' share of the project and allowed it to be paid over 50 years, interest-free. Approximately one-quarter of the originally estimated $225 million project is to be covered by nonfederal, cost-sharing funds from the eight Great Lakes states. The Michigan, Illinois, and Pennsylvania legislatures all appropriated in the summer of 2001 to cover their contributions toward the new lock, to be built on the St. Marys River between Lakes Huron and Superior. The remaining five Great Lakes states have also committed to supporting the project and are in the process of securing appropriations to cover their shares. After a lengthy review at the U.S. Army Corps of Engineers headquarters, a Limited Reevaluation Report (LRR) revisiting initial benefit-cost ratio calculations for the project has been forwarded to the Assistant Secretary of the Army (Civil Works) with a recommendation to proceed with construction. At last report, the LRR was still awaiting action. In Congress, the Water Resources Development Act of 2005 has been introduced with language inserted by Cong. James Oberstar (D-MN) calling for full federal funding of the Soo Lock expansion project.

The new large lock will improve shipping reliability and efficiency on the Great Lakes by replacing two small World War I-era locks. Only the Poe lock at Sault Ste. Marie, can handle the 1,000-foot lake vessel. A malfunction of this lock would require that tens of millions of tons of product would have to shipped on smaller vessels or moved by other modes through the most congested rail and highway routes in the Midwest.

V. Non-Physical Challenges to Optimizing the GLMTS

A vessel that is suitable for the trade and capable of providing competitive economic returns on the investment is one of the most critical components of any viable transportation mode, the marine service is no different. The ability to acquire suitable cost effective vessels in a competitive market is essential to establishing new maritime trade routes or revitalizing existing traffic lanes.[8] Vessel selection is typically driven by legal factors, physical constraints and availability of reasonably priced vessels. Regulatory barriers exist that currently limit the optimal use of the GLMTS.

Taxation and Border Clearance

In 1986, the Harbor Maintenance Tax (HMT) was enacted by Congress to recover a portion of the cost of maintaining, not improving, the nation's deep-draft navigation channels. The amount of tax paid by the shipper, who owns the cargo, was based on the value of the goods being shipped. In addition, a cost-share formula was implemented for improving (widening and deepening) harbors and channels, with local port sponsors paying a part of the cost and the Federal government paying a portion from the General Treasury.

Congress decided to fund 40 percent of maintenance costs from the HMT after much debate and discussion about the broad, national benefits of waterside infrastructure and concerns about the impact of a tax on trade and competitiveness of U.S. ports. An ad valorem tax, rather than a tonnage tax, was chosen to minimize the impact on U.S. exports, particularly price-sensitive bulk commodities.

In 1990, Congress more than tripled the HMT to recover 100 percent of maintenance dredging expenses. The current HMT tax rate is .125% of the value of the cargo. The HMT collected from commercial navigation also funds the roughly $80 million expended each year to dredge shallow-drafts ports used primarily for recreational purposes.

The U.S. Supreme Court issued a short, unanimous decision in March 1998 finding the HMT unconstitutional as applied to exports. The decision states that the HMT is a tax, not a user fee, because the ad valorem tax is not a fair approximation of services, facilities or benefits furnished to the exporter.

Customs fees and hours of service have proven to be a barrier to optimizing the use of the GLMTS. The Canadian Customs has limited the hours that they would clear vessels on cross border trade. US Customs charge overtime and travel expenses to clear vessels. Truck and rail operators are able to have 24 hours service with no recovery charges. The agencies in charge of protecting borders need to be able to fulfill their missions and still ensure that the GLMTS operates at maximum efficiency.

There are exemptions to the HMT including maritime trade between the US mainland and Hawaii, Alaska, Guam, and Puerto Rico. The impact of the HMT on US-Canada trade on the Great Lakes is severe. The tax impacts NAFTA short sea shipping service to a much higher degree than ocean traffic for several reasons. A vessel that carries multiple cargoes such as the Detroit Windsor Truck ferry is unable to attract additional business such as UPS trucks because each shipper in the truck will have to pay the tax creating a paperwork issue on less than truckload cargoes.[9] A cargo shipped on a trailer shipped on a RORO vessel with a $500.000 value shipped from a Canadian port to a US port will have to pay $625 US in tax. The same trailer can be transported by a truck with no tax paid. Because there is not limit on the number of voyages that are taxed, the frequency of service of a short sea shipping vessel means taxes collected from the vessel will far exceed the cost harbor maintenance incurred by that vessel.

Cabotage Laws

Cabotage laws restrict entry into domestic transportation markets by other nations. While maritime cabotage laws are the oldest, they are not unique to the transportation industry. The US does not allow foreign flag airlines to operate on domestic routes such as Chicago to Buffalo and there are cabotage restrictions on trucking for drivers, ownership, and routes. However the restrictions imposed by maritime cabotage laws are the most arduous of all the modes of transportation.

A vessel that carries freight from one Great Lakes U.S. port to another U.S. port without stopping in Canada must fulfill the requirements of the 1920 Jones Act authored by Senator Wesley R. Jones. A vessel that carries passengers must meet the requirements of the U.S. 1896 Passenger Vessel Services Act. Both acts require that the vessel be built in the U.S., that U.S. citizens own a majority of its stock, and that it is crewed by U.S. citizens. In the global market place these constraints have placed American Flag vessels at a competitive disadvantage. The costs of capital, crews, and taxation has resulted in a U.S. shipbuilding base that produces very few large vessels and a merchant marine that carries less than 3%[10] of its imports and exports.

The relatively isolated location of the Great Lakes and the nature of the cargoes carried in interlake trade have allowed the existence of a relatively robust U.S. flag bulk cargo fleet. However, the Great Lakes shipbuilding industry has not built a new vessel for the Great Lakes in two decades. The building boom of the 1970s was driven not only by innovations in shipbuilding techniques that resulted in the 1000-foot (305 meter) length over all lake vessels, but was also aided by government subsidies in the form of Title XI ship financing and tax credits.[11] Considering the current high cost of shipbuilding in U.S. shipyards, the prospect of a new U.S. vessel built is problematic at best and then only with government subsidies. The Jones Act as currently applied stifles the ability of ship owners to start new operations, stifles entrepreneurial endeavors, and severely limits the importation of technological advances in shipbuilding.

Canadian flag operators face similar economic constraints. The Coasting Trade Act of 1992 regulates vessels that operate between two contiguous Canadian ports. The Coasting Trade Act allows only Canadian flag vessels crewed with Canadian citizens to carry freight or passengers between two contiguous Canadian ports. One critical difference from U.S. acts is that the Canadian Coasting Trade Act allows the purchase of vessels built foreign to be flagged as Canadian vessels provided permission is obtained, they meet Canadian safety regulations, and all applicable duties have been paid[12].

The primary difference between the marine cabotage laws and those applying to other modes is the marine operators restrictions on vessel building and purchasing. The necessity to maintain a shipbuilding/repair industry is not in question any more than a trucking or aircraft industry. However the building requirement in the marine laws have inhibited technological advancement in merchant shipbuilding and have raised the cost of ships to the point that the purchase price is a barrier to entry in any new markets that could be developed on the GLMTS. The US Government has recognized this fact and has subsidized shipbuilding however this fix has not resulted in a healthy merchant shipbuilding base especially in the GLMTS. The expansion of the GLMTS requires a shipbuilding/repair base as well as cost effective ships and this issue must be addressed or there can be no meaningful use of vessels for domestic trade on the GLMTS. Business models used by other modes of transportation where a significant portion of the vehicle or plane are made in other countries, the modular parts shipped to the US then assembled at US locations should be explored.

Pilotage Issues

There is the possibility to use a foreign flag vessel on some intralake route, as the vessel would be engaged in international trade. However one of the requirements that would be imposed on a foreign flag vessel on those routes is that the maritime laws of both nations would require that pilots be employed. By International agreement between the United States and Canada, the waters of the Great Lakes and the St. Lawrence River have been divided into designated and undesignated waters for pilotage purposes. In designated waters, registered vessels of the United States and foreign vessels are required to have in their service a United States or Canadian registered pilot. In undesignated waters, registered vessels of the United States and foreign vessels are required to have in their service a United States or Canadian registered pilot or other officer qualified for Great Lakes undesignated waters. The US pilots operate under the direction of the US Coast Guard [13] The Great Lakes Pilotage Authority Canada manages the Pilotage system for all waters in the Province of Quebec south of the northern entrance to St. Lambert Lock and all Canadian waters in and around the provinces of Ontario and Manitoba.[14] Pilotage in the international waters within the boundaries is shared under a memorandum of arrangements between Canada and the United States.[15] The cost of the pilots is several hundred dollars per day.

There is a compelling need to protect lives and the environment by using well trained certified navigation officers who have the required knowledge of the waterways. Pilotage service will continue to be needed for vessels entering from the sea. Several studies have been undertaken on the Great Lakes Pilotage system and the all conclude that there is room for improvement. An optimized pilotage system on the GLMTS would provide high quality pilots to vessels at a reasonable rate, have minimal, if any, impact on vessel schedules or routes, and minimize overhead costs not directly related to pilotage. At present, each of the districts operates as an independent business owned and operated by the pilots who work within the boundaries of these districts. The GL MTS might be better-served by a single pilot organization that seamlessly coordinates vessel movements through the entire seaway.[16]

Ballast Water and Air Pollution Issues

Environmental and economic threats posed by non-indigenous species to the Great Lakes, such as zebra mussels, the round goby, and European Ruffe, are well documented. Ballast water has been the major route for the introduction of many aquatic nuisance species into the Great Lakes, including the zebra mussel. The problem of ballast water transport of non-indigenous species is not unique to the Great Lakes. On the East Coast, ships have introduced the Japanese Shore Crab; in the Gulf, the Brown Mussel; on the West Coast, the Chinese Mitten Crab along with numerous other species. Since not much can be done to control the invaders already established in the Great Lakes, policymakers are focusing attention on how to prevent further infestation

Current U.S. regulations concerning ballast waters were brought about by the passage of the Nonindigenous Aquatic Nuisance Species Prevention and Control Act of 1990. The US Ballast Water Management Regulations are enforced by the U.S. Coast Guard Marine Safety Office in Buffalo, New York Enforcement efforts are primarily focused through USCG Marine Safety Detachment in Massena, New York, due to its location at the beginning of the U.S. waters of the St. Lawrence River.[17]

The State of Michigan in 2005 passed a ballast law that further restricts how oceangoing vessels can operate on the Great Lakes.[18] This state may spur other state laws. A fragmented and unilateral approach to transportation regulation has never been successful. Studies to address the ballast water issue are underway and should be strongly supported at

all levels. This is a world wide problem and solutions should be sought wherever they can be found.

A number of studies have been done on the environmental benefits of marine transportation.[19] Specific studies on the GLMTS provide clear evidence that the environmental benefits of marine transportation on the GLMTS are significant.[20] The introduction of exotic species by ballast water is an issue just as the movement of wood pests by pallets on trucks or trains are and ballast water must be addressed.

In 2006 the EPA is starting the process of examining the levels of air pollutions from vessels. This follows from studies that have been done on air pollution from vessels calling at the US West Coast. The impact of the operations of Great Lakes vessels is unknown at this time. The University of Minnesota-Duluth, sponsored through the Great Lakes Maritime Research Institute, is studying the use of bio-diesel fuels on Great Lakes merchant ships to reduce air pollution and provide a domestic fuel source for the vessels auxiliary engines.

Gentrification of the Waterfront

Increased use of the GLMTS will require increased investment in plant and equipment at the marine cargo terminal. The marine cargo terminals are in an escalating struggle with commercial developers who want to acquire waterfront property for non-maritime uses. There are numerous zoning codes and ordinances at the state and local level that may present barriers to expansion. In some instances state and local laws favor maritime trade. One interesting note is that Wisconsin's state constitution prohibits the use of filled land sites (land created from prior waterways) for any purposes except public reaction or maritime commerce. This effectively put off limit large tracts of harbor front created from dredge or other fill material from having non-maritime commercial development.

Planning at state regional and local levels need to consider the long term impact of removing the possibility of waterfront being used for maritime commercial purposes. Once the waterfront including rail and truck corridors is developed for housing or other non-freight uses, the possibility of returning at a future date it to maritime commerce are remote.

VI. New Opportunities to Optimize the GLMTS

Hub and Spoke System

Except for a limited number of ferries, scheduled marine service has not existed on the GLMTS since the 1960s. Vessels have sought out freight and carried it from origin to destination. With the advent of intermodal systems and supply-chain management there is an opportunity to add a new dimension in maritime service on the GLMTS. The establishment of liner service that carries RORO or LOLO traffic similar to the models used in northern Europe and the Mediterranean has potential in the GLMTS. The majority of Great Lakes vessels currently seek long term chartered cargoes.[21] A new liner service would have the vessels carry trucks with trailers, trailers and or containers. The trucking industry seeks out the shippers and the marine carrier is a link in the supply chain for the trucker moving the shipper's cargo. A timely cost effective scheduled service tied to hubs would, to a degree, provide the trucker with relief from hours of service issues, fuel costs, maintenance costs and congestion. In order for such a service to be successful several parameters have to be met: reliability, minimal cargo damage, low cost of capital for the vessel, low vessel operating cost, routes that bypass congestion nodes and easy access to interstate or other high speed road systems from the ports. Studies on schedule services that could carry freight often recommend that passengers be included as an additional revenue stream.[22]

Dedicated Freight Corridors

One of the tremendous advantages of the GLMTS is its ability to transport heavy cargos. The different state and federal road weight limits create constraints to the efficient and economical movement of paper, wood, steel and other dense products. The creation of freight corridors that connect cluster centers to ports on highways engineered for the load would allow heavyweight trucks to connect to RORO type vessels. The freight can then be moved to another port with another freight corridor connecting that destination port with distribution centers or another production cluster. These corridors would take heavy freight off the highway system lowering pavement impact as well as freight costs

New Asian Gateway

Construction has started on the Prince Rupert, British Columbia container terminal. The $127 investment should have an operational terminal by 2007. The sailing time from Hong Kong, China to Prince Rupert terminal is 36 hours closer than sailing to Long Beach and 20 hours closer than sailing to Vancouver, BC. The rail transit from Prince Rupert to Chicago is 22 hours closer than a train from Vancouver, BC.[23] The new terminal has the potential to rapidly grow because of its, lack of congestion, shorter route and elimination of the US Harbor Maintenance Tax on the imported cargoes. The CN rail route passes thought Duluth/Superior creating the potential for GLMTS link.

The population base of Duluth Superior alone is not sufficient to warrant the establishment of an intermodal terminal.[24] However, draying cargo from the Duluth/Superior to the Minneapolis St. Paul Metropolitan region is approximately 700 miles closer and 21 hours faster than the Prince Rupert intermodal train going down south to CN's Chicago intermodal terminal then drayed back north on I-90/94 to the Twin Cities. The Metropolitan Statistical Area of the Twin Cities and surrounding region represent a market of 4.3 million people. An intermodal terminal in Duluth/Superior with a direct route to Asia would present an opportunity for containers and containerizable cargo to be moved by water from the lower lakes to the head of the lakes. There may be the critical mass of cargo to establish a cost effective GLMTS hub for RORO and container trade. Similar intermodal marine links may exist in Toledo or Chicago.

New Vessel Designs

A joint venture between privately held companies Van Enkevort Tug and Barge (VET&B) and K&K Warehousing is investing in a new shipbuilding and repair facility will be located at the Erie-Western Pennsylvania Port Authority-owned shipyard. The project was a united effort between PennPORTS, a division within the Department of Community and Economic Development, and the Erie Port Authority. VET&B has committed to build a new 780-foot self-unloading laker (barge) and four 135-foot icebreaker certified tugs, which are scheduled to go into operation in 2008. The company has also committed to converting at least four additional 780 foot-long straight deckers and self-unloading barges in the next five years. The use of Integrated Tug Barge (ITB) systems will increase in the years to come in order to take advantage of crew size reductions and available Jones Act hulls. A 2005 survey of Great Lakes ship owners by the US Maritime Administration found that those ship owners would prefer ITB for future ships.[25]

The school of Naval Architecture at the University of Michigan is researching a ballast free design that uses a ballast flow through design. European shipyards are building "green ships" that are RO/ROs designed for ice service with ballast systems that have electrical shore connections, "Optimar" systems that sanitize ballast water and a ballast system that has no

sediment. [26] These vessels can carry 100 trailers while operating with a crew of 12 in the highly congested Baltic & North Sea waters and these vessels are able to fit through the St. Lawrence Seaway locks. Additional vessels with out engine rooms and designed to go from lake to river to ocean are on the drawing boards.

Information Systems Applications

The growth in information systems applications continues to improve efficiencies in GLMTS. Success of this approach requires inexpensive, reliable, paperless freight handling, so that all aspects of goods transport can be arranged, tracked, and managed electronically. There are still many breaks in the chain of electronic data, including restrictions on the use of automated data systems in many port facilities and continuing governmental requirements for some paper documents including redundant overlapping forms such as multiple crew lists. Elimination of these breaks and extraneous paperwork will allow freight to be handled more efficiently, reliably, and quickly, creating a more efficient supply chain.

A reoccurring issue in GLMTS monitoring is the dispersed and sometimes difficult to access data on the system. A single location for storage, access and retrieval that would provide accurate, un-biased data is needed.

A Seamless GLMTS

It is now possible to have seamless, paperless tracking of all freight movements and transactions between parties. It is also possible to automate equipment assignments in the terminal and to optimize terminal operations in the face of complex, competing demands. Increased use of the GLMTS will result in increased rail and road traffic in the ports. In an effort to manage and reduce road truck congestion, many ports worldwide have invested in port traffic coordination systems. Coordination of transportation planning thought state and regional planning commissions so that freight traffic flows in an out of the ports with a minimum of implementation could further reduce the environmental impacts of port operations.

The Future of the GLMTS

In order to handle the projected increased foreign and domestic trade the GLMTS partners must provide for and maintain harbors, adopt new terminal technologies, remove non-physical operational barriers, and implement state of the art information systems. A GLMTS that is not utilized to its full potential or in decline will result in present cargo being shifted from the waterways and future freight moving to land based modes, creating additional strain on the nation's rail and highway system and further adding to the deterioration of infrastructure. A GLMTS should be developed that is based on the principals of sustainable development and continues to benefit the environment as well as the economy of the Midwest. The needed infrastructure and technological investments will be achievable with a strong and committed partnership of the private sector, federal, state, provincial and local governments.

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